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# Central Analytical Laboratory

Thousands of precipitation samples are collected each year by the National Atmospheric Deposition Program/National Trends Network (NADP/NTN), the nation's acid rain monitoring network. A network of this size and importance requires careful, accurate laboratory analyses. Since the network's beginning in 1978, it has relied on its Central Analytical Laboratory (CAL) at the Illinois State Water Survey to fulfill its need for high-quality analyses and data.

## Monitoring the Problem

Air pollution is recognized as one of our nation's serious environmental concerns. Emissions of sulfur and nitrogen oxides from industry, electric power plants, and transportation enter the atmosphere, where they are transformed into sulfuric and nitric acids. These pollutants can travel hundreds or even thousands of miles before their capture and subsequent appearance as acid rain or snow. This is just one way that human activities change the chemistry of our atmosphere, i.e., our chemical climate. To monitor this change, the NADP, a cooperative research project of the State Agricultural Experiment Stations and other federal, state, and private research organizations, began operating a sampling network in 1978.

In 1980 the U.S. Congress passed the Acid Precipitation Act, which called for comprehensive research under the National Acid Precipitation Assessment Program (NAPAP). NAPAP plans included a network to detect and measure the intensity and trends of acidic precipitation. This new network, the National Trends Network (NTN), adopted most of the NADP sites then in existence and all of the NADP methods. By 1986 the combined NADP/NTN had grown to nearly 200 sites located across the United States, American Samoa, Puerto Rico, and Canada.

Today the NADP/NTN continues to provide data for research on the chemical climate and its effects on our environment. With the passage of the newly amended Clean Air Act in November 1990, NAPAP's future has been extended indefinitely.

## CAL Beginnings

When it was formed, the NADP network required a single laboratory to analyze its samples. This laboratory had to meet strict

analytical performance requirements and provide the network with a stable, responsive laboratory team. Chemistry labs at the Illinois State Water Survey had both experience in operating rain chemistry networks and a group of trained, fully qualified personnel who could accurately measure the low concentrations of chemicals found in rain samples.

As the search for a central lab began, the Water Survey labs entered the competition with other labs from around the nation. Each lab received synthetic rainwater samples for analysis and a visit by a site selection team that interviewed lab personnel. The NADP chose the Water Survey labs to be its Central Analytical Laboratory (CAL).

## The Lab

Water Survey chemists perform the precipitation analysis at the CAL, and atmospheric scientists perform the data management. Teams from other agencies periodically evaluate both groups to ensure that their performance continues to meet all

program requirements. When NADP began, the lab received samples from about 20 network sites. An initial staff of six grew to meet the demands of an expanded network of up to 200 sites. Facilities and equipment also expanded and improved to keep pace with network growth and the latest technological advances.

In addition to precipitation analysis and data management, the CAL validates field-site measurements, provides sampling supplies to all sites, assists site personnel with operational problems, and conducts training courses for site operators.

## Journey of a Precipitation Sample

Field technicians collect weekly precipitation sample buckets at the sites. After they record information about the collection and weather conditions, they carefully pack the sample buckets and send them to the CAL.

Each sample is checked in, weighed, inspected, measured for acidity, filtered, and placed in two clean bottles. As a quality assurance precaution, one bottle is refrigerated and stored for a minimum of five years. The sample in the second bottle, which is kept at room temperature, is ready for detailed chemical analysis. Individual chemicals are identified and their concentrations are determined by a variety of standardized methods, including ion chromatography, atomic absorption spectrophotometry, and automated wet chemistry.

All stages of sample collection, handling, and analysis follow carefully designed procedures and strict quality assurance controls. These controls include analyses of "blind" samples whose chemical makeup is unknown to the chemists but is known to quality assurance personnel who continually

check the precision and accuracy of all CAL analyses.

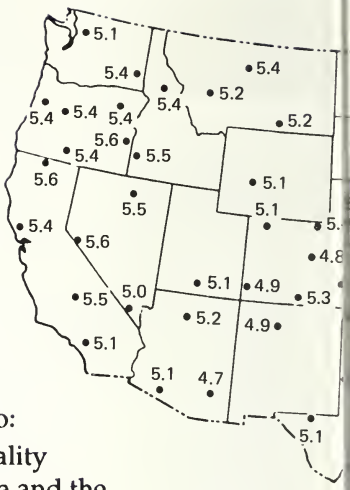
The journey through the analytical laboratory takes one to two weeks. The data are then sent to the data management group for categorizing, critical review, and coding. Information is added that will enable data users to select the data most appropriate for their use. These tasks take several months to complete and include manual and computerized checks, reanalysis of about six percent of all samples for quality assurance, and follow-up telephone calls and written communications with site personnel.

## The Data and Their Use

The analytical results and background information on each sample are stored in computer files by the CAL data management group and transferred monthly to the NADP/NTN Coordination Office at Colorado State University.

The data are compiled by the Colorado

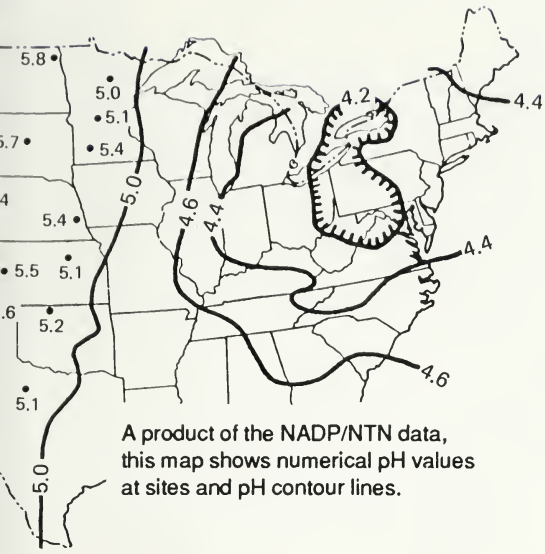
group, which prepares tables, graphs, and maps summarizing trends in the chemistry of precipitation. These reports are sent to scientists and leaders in industry and government.




The NADP/NTN data have been used to:

- Negotiate an air quality treaty between Canada and the United States.
- Identify U.S. areas that are sensitive to acid rain.
- Evaluate the atmospheric response to regional changes in emission control strategies.
- Assess the state of science of wet deposition monitoring in North America.

Among the many data users are atmospheric scientists, agronomists, ecologists, foresters, plant pathologists, paper companies, paint manufacturers, and the electric power industry.




A product of the NADP/NTN data, this map shows numerical pH values at sites and pH contour lines.

## Evaluation and Performance

The CAL conducts applied research to evaluate and improve its methods and procedures. Its ongoing evaluation of new approaches helps ensure the efficient production of the highest quality data. Data analysis ensures that the CAL scientists have up-to-date information about changing issues such as pesticides in precipitation, other hazardous chemical deposition, the role of air quality in climate change, and the impacts of emissions reductions on precipitation quality.

Further evaluation of the CAL includes ongoing intercomparisons with labs of the World Meteorological Organization, U.S. Environmental Protection Agency, U.S. Geological Survey, National Water Research Institute of Canada, and European organizations. CAL performance, always rated highly, has ranked number one in many of these studies. Because Water Survey scientists have refined and documented the methods for handling and analyzing precipitation, several national agencies and organizations have adopted them as standard methods.

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